165 Hypoxic challenge testing and air travel: the Welsh experience

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Background and Aim: Increasing numbers of CF patients are making increasingly diverse travel plans. Following the British Thoracic Society recommendations on air travel from 2011 we reviewed our experience of Hypoxic Challenge Testing (HCT) since its availability in our centre six years ago and reported adverse flight events.
Method: FEV1% and saturations on room air (SpO_2) were collected retrospectively on all adult CF patients referred for HCT and any subsequent adverse flight events reported by patients noted. Previously described non linear equations were used to try to predict HCT result.
Results: Of the 312 HCT performed 45 (17 male) were CF patients with mean age 27.3 years (range 16–47), FEV1%predicted 45.0±19.4% and SpO_2 96.0±1.7%. 10/45 HCT were positive (5 male) of whom 9 had FEV1% <50% and 7 had SpO_2 <95%. Using FEV1% <50 alone to predict a positive HCT has a sensitivity of 32% and specificity of 94% and using SpO_2 <95% alone has sensitivity and specificity of 78% and 92%respectively. The nonlinear equations were no better than FEV1% or SpO_2 alone in predicting HCT outcome in this group. No adverse effects were reported during air travel by patients.
Conclusion: Neither FEV1%, SpO_2 or non linear equations appear to accurately predict HCT result in our cohort and this reflects previous studies. However, previous studies, although in small numbers, have also suggested hypoxia is relatively well tolerated in patients with CF and no adverse effects were reported by our patients. HCT itself does not predict fitness to fly and other factors such as destination altitude, insurance provision, sinus disease and medical availability are also clearly important.

166 CF sputum rheology and the role of the airway mucin MUC5AC

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Objectives: Thick, tenacious secretions causing impaired mucociliary clearance & airway obstruction are a hallmark of CF. There is conflicting evidence about the relative role of the major airway mucins MUC5AC & 5B in determining physical properties of sputum. To investigate the role of MUC5AC & the effects of proteolytic degradation, we have assessed CF sputum linear viscoelasticity (rheology) and MUC5AC properties before & after incubation for 60 mins at 37ºC.
Methods: Whole sputum was collected from CF patients during an exacerbation. Elastic moduli (G') and dissipative moduli (G'', related to viscosity) were calculated on 100 µl aliquots from a dynamic oscillatory test at 1 Hz using a constant stress of 1Pa. Mucins were solubilised in GnCl and MUC5AC amount & size distribution analysed by agarose gel electrophoresis & Western blotting using the 5AC peptide-specific antibody MAN5AC-I.
Results: Paired rheology data were obtained on 9 samples from 8 patients (median age 23 yrs, median FEV_1 28%). After incubation, G' fell from a mean of 7.98 to 3.99Pas (mean fall of 44%, $p < 0.001$). G'' fell from 3.46 to 1.62 Pas (46%, $p < 0.001$). Preliminary data on a subset indicate MUC5AC antibody reactivity fell from mean [MUC5AC] 6.3 µg/ml to 3.9 µg/ml, $p < 0.05$. In addition, there was a shift towards lower molecular weight forms.
Conclusions: There was loss of MAN5AC-I epitopes in sputum samples over time, indicating degradation of mucins by proteases within sputum and confirmed by altered electrophoretic migration. This may also be responsible for the observed changes in sputum rheology. Work is ongoing to further characterise the relationship between mucins & rheological properties of sputum.

167 Growing flow to volume dysanapsis in cystic fibrosis − a predictor for lung transplantation?

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Airways-obstruction and lung volume restriction, a major features of lung disease in cystic fibrosis (CF), may regress independently, causing growing dysanapsis between these parameters.
Objective: To explore longitudinal changes in mid-flows to vital capacity (FEF25–75/FVC) ratio in CF.
Methods: Yearly best spirometry data, collected 8.6±1.0 years/patient, was determined from 93 CF-patients. Three groups were formed according to initial FEV1. Group-N (n = 35; control (FEV1 >80% predicted); Group-B (n = 38; FEV1 <80% predicted); Group-LT (n = 20) data collected prior to lung transplantation. The yearly declines in spirometry indices were defined in relation to the former year. Decline exceeding −2 Z-scores from Group-N in each index was considered "rapid".
Results: Group-N's yearly-decline of FEV1, FEF25−75 and FEF25−75/FVC were similar (−1.88±2.93%; −1.41±3.37 and −1.81±4.48% respectively). Group-B's yearly decline-rate of FEV1 and FEF25−75 was faster than that of Group-N but did not exceed a single Z-score. Group-LT showed a rapid decline solely in FEF25−75/FVC (mean Z-score = −6.4±2.5; $p < 0.0001$) that sprouted abruptly from the regular course of regression 4.0+1.3 yrs prior to transplantation. The phenomenon did not correlate with initial FEV1 (%predicted) or age. Having airway hyper-reactivity and/or *Mycobacterium abscessus* increased the risk of rapid decline in FEF25−75/FVC.
Conclusions: Rapid decline of FEF25−75/FVC ratio several years prior to transplantation may indicate irreversible lung damage and may be a powerful marker for estimating that time in patients with CF.

168 A protocol to determine $\dot{V}O_{2max}$ in young patients with cystic fibrosis: recommendations for clinical practice

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Objectives: Maximal cardiopulmonary exercise testing (CPET) assessing aerobic metabolism [maximal O_2 uptake ($\dot{V}O_{2max}$)] is an important clinical tool in cystic fibrosis (CF). However the optimal protocol to ensure valid determination of $\dot{V}O_{2max}$ has not been clarified. The present study sought to examine the utility of a supramaximal exercise test (S_{max}) following CPET to determine valid $\dot{V}O_{2max}$ in young CF patients.
Methods: Fourteen patients (7–18 y; 4 female, 10 male) completed an incremental ramp cycle test to volitional exhaustion to determine their $\dot{V}O_{2peak}$. Following 15-min recovery a S_{max} cycling test to exhaustion was performed at an intensity equivalent to 110% ramp peak power output. $\dot{V}O_{2peak}$ was taken as the highest 15-s stationary average, in addition to traditional verification criteria.
Results: S_{max} elicited a similar $\dot{V}O_{2peak}$ to the ramp (1.815±0.688 vs. 1.825±0.821 L/min; $P = 0.403$; $r = 0.94$) in 73% of cases, despite exercising at a higher power output (171±85 vs. 191±93 W). This was despite many patients failing to satisfy traditional criterion during the original ramp test: $\dot{V}O_2$ plateau (79%); blood lactate (23%), 85% age-predicted maximum heart rate (HR) (17%) and a HR of 195 beats/min (58%). However, all patients satisfied the RER >1.06 criterion.
Conclusions: In most cases, S_{max} can confirm $\dot{V}O_{2max}$ in this population. It is recommended as *the* sole criterion for substantiating 'true' $\dot{V}O_{2max}$ within future clinical practice and scientific research as a clinically useful protocol to provide superior information.
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